SYNCHRONIZATION OF COUNTERSHOCK IN VENTRICULAR DEFIBRILLATION

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Defibrillation of the heart occurs when a critical mass of myocardium is depolarised simultaneously, usually by electrical means. If the peaks and troughs of ventricular fibrillation (VF) indicate differing ratios of depolarisation to repolarisation in the heart, then the minimum energy required for defibrillation might be different for shocks synchronized to either the peaks or the troughs of the VF waveform. Lowering the energy required for defibrillation would minimise the chance of myocardial damage due to the countershocks themselves.

12 dogs were anaesthetised with pentobarbitone and ventilated. Arterial blood pressure, pH, and the ECG were monitored. VF was induced electrically via a pacing wire in the right ventricle. A custom built synchronization circuit sensed the peaks of the VF waveform. After a preset delay it triggered the defibrillator discharge so that the shock was delivered either at the following trough or the next peak.

Is VF a random arrhythmia? Spectral analysis of VF showed a periodic component in the arrhythmia, suggesting that synchronization of defibrillation might be possible. The first 40 seconds of VF (10 dogs) showed a dominant frequency of 11.48 + 0.54 Hz (mean + SEM) with -3 db limits of 10.64 + 0.54 Hz (lower) and 12.21 + 0.51 Hz (upper).

The ventricular defibrillation threshold was determined as the smallest transthoracic shock to defibrillate the heart. Each experiment was divided into 3 runs and in each run, the ventricular defibrillation threshold was found either for transthoracic shocks delivered to the peaks of VF, to the troughs of VF, or for shocks delivered in unsynchronised mode.

There was no significant difference in the threshold delivered current or threshold delivered energy for shocks synchronized to the peaks of VF, to the troughs, or for unsynchronized shocks.

This study supports the previous reports of some periodicity in the VF waveform. However there appears to be no advantage in using synchronized transthoracic countershocks in VF.